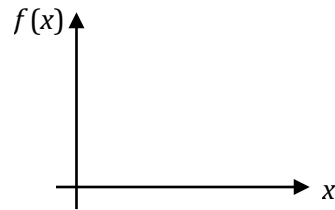


## Basic Differentiation Rules

### 1. The Constant Rule:

The derivative of a constant function is 0.

For any real number,  $c$ :  $\frac{d}{dx}[c] = 0$



A.)  $y = -4$

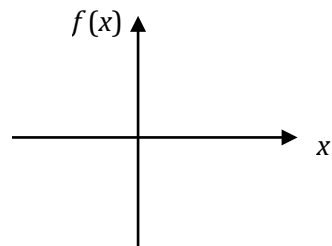
B.)  $s(t) = 45$

C.)  $f(x) = 0$

D.)  $y = \frac{k\pi}{2}$

### 2. The Single Variable Rule:

The derivative of  $x$  is 1.  $\frac{d}{dx}[x] = 1$   
Think graphically about the line  $y = x$ .



A.)  $f(x) = x$

B.)  $s(t) = t$

C.)  $x(t) = t$

### 3. The Power Rule:

If  $n$  is a rational number then the function  $x^n$  is differentiable and  $\frac{d}{dx}[x^n] = n \cdot x^{n-1}$

EX #1: Use the power rule to find the derivatives of the following, if:

A.)  $y = x^2$

B.)  $f(x) = x^4$

C.)  $y = \sqrt{x}$

D.)  $g(x) = \frac{1}{x}$

E.)  $f(x) = \frac{1}{x^2}$

F.)  $y = \frac{1}{x^{2/3}}$

4. The Constant Multiple Rule:

The derivative of the term  $ax^n$ , where  $a$  and  $n$  are real numbers, is  $(a \cdot n)x^{n-1}$

EX #2: Use the constant multiple rule to find the derivatives of the following, if:

A.)  $y = 3x^2$

B.)  $s(t) = -5t^3$

C.)  $y = 6\sqrt{x}$

D.)  $g(x) = \frac{3}{x^2}$

E.)  $f(x) = \frac{4}{\sqrt{x}}$

F.)  $y = \frac{-8}{\sqrt[3]{x^4}}$

5. The Sum and Difference Rules:

The derivative of a sum or difference is the sum or difference of the derivatives.

$$\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x) \quad \text{and} \quad \frac{d}{dx}[f(x) - g(x)] = f'(x) - g'(x)$$

EX #3: Use the Sum and Difference Rules to find the derivatives of the following, if:

A.)  $f(x) = x^3 - 5x^2 + 2x - 7$

B.)  $y = \frac{2}{5}x^5 + x^4 + 3x^2 - 1$

C.)  $g(x) = \sqrt[3]{x} + 5\sqrt{x}$

D.)  $y = 5x^{3/2} - 6x^{5/3} + \frac{4}{x}$

E.)  $h(x) = 3x^2 - \frac{4}{x^2} + 2\sqrt{x}$

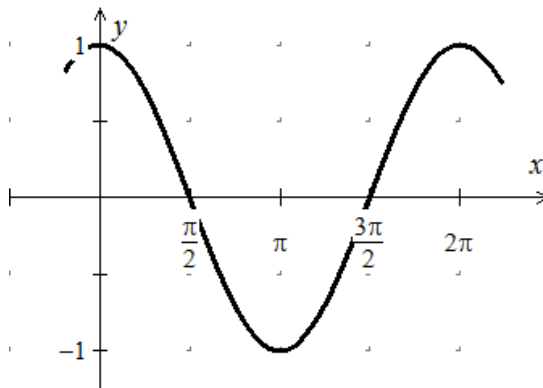
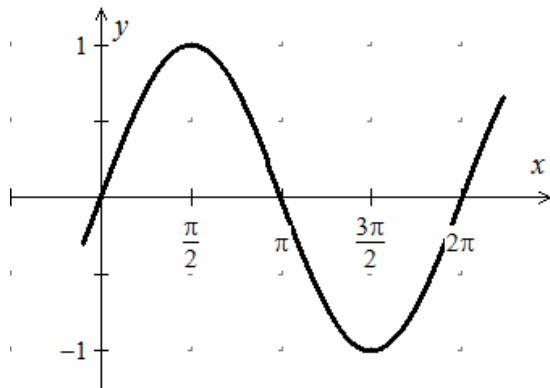
F.)  $f(x) = \frac{8x^3 + 4x^2 - 3}{x}$

## 6. Derivatives of Sine and Cosine Functions

The derivative of a sum or difference is the sum or difference of the derivatives.

$$\frac{d}{dx}[\sin x] = \cos x \quad \text{and} \quad \frac{d}{dx}[\cos x] = -\sin x$$

EX #4: The derivative of the sine function is the cosine function.



Find the derivative of the sine function by using the limit process.